Menlo Park Notebook #8 [N-78-12-20.2]

This notebook covers the period December 1878-June 1879. Most of the entries are by Francis Upton. There are also entries by Edison, Charles Batchelor, John Kruesi, and George Jackson. All of the material relates to experiments on electric lighting. There are notes and calculations by Upton about meters, a series of tests by Upton on generators, and Upton's calculations for an electric lighting system. Other material includes a test machine for driving magnetos, designed by Batchelor and built by Jackson; notes by Edison on hand turning a generator; and drawings by Krusei showing the layout of pipes in one of the laboratory buildings. The label on the front cover is marked "Faradic machines No. I" and "Electro deposition Tests." The book contains 284 numbered pages.

Blank pages not filmed: 76-77.

No 8

LIBRARY OF THE

BOARD OF PATENT CONTROL,

120 BROADWAY, NEW YORK.

GENERAL ELECTRIC.

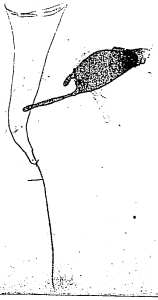
_____, 189_

On fund. 150 A. 14

Pa

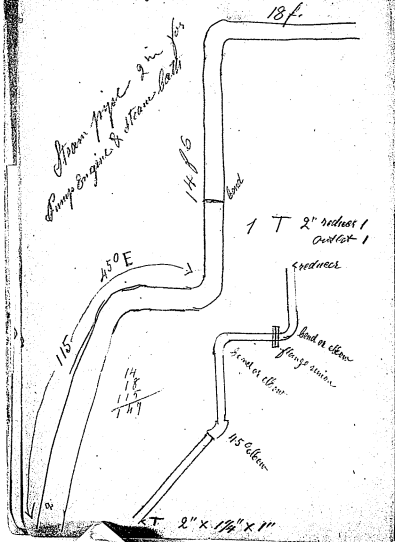
"Important extract relating to patent no 460156 of T. A. Edison, March 31, 1891 (Edison Journal)"

4554
2834
25502
9834
460156
31416

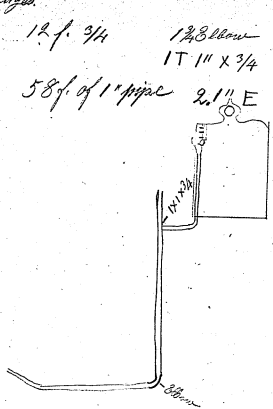


water

Starting Point from Snowdes pump



Trip pipe from exhaust & water gauges



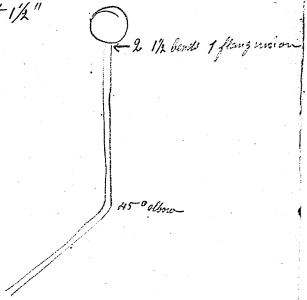
Supply pipe for cistern
all 1½" galvanized

2 1½ bends ex. 2 coupling

2 45° Elbows

1

100 ft 1½"



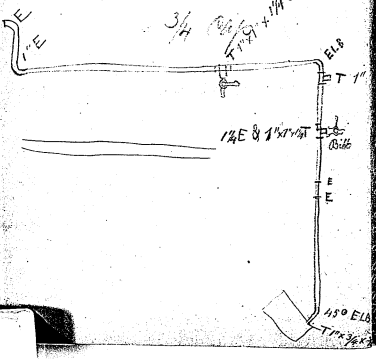
Water supply from Gallery to
& through Main Building

60 1 T. galvanized
122 4 E 2 T
1

1 45° E 1"

4 1" nipples

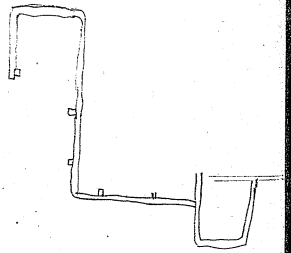
3/4 [illegible] + 1/4 [illegible] E

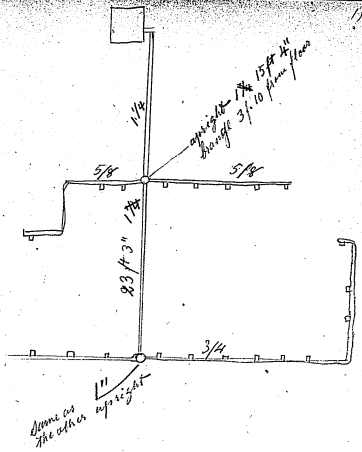


150 ft of 2 in. plain piping for steam under
boiler pressure for S
100 ft galvanized pipe 1½
45 " " " 1 inch for small use in p.
100 ft of 1" plain pipe
90 " " 1¼ " "

2. 2" wrought iron bends of steam
3. 2" flange unions
3. 2" shoulder nipples
2. 2" Globe valve for steam
1. T 2" = 2" X 1" " "
bushing ~~from 2" to 1~~ to reduce from 2" to 1¼
4. T 1" = 1" X 3/4
3. 1" Elbows
4. 1" nipples shoulder
4. 3/4 " " extra 1½ oppo
1½ " wrought iron Bends
1½ nipples shoulder
1½ elbows gang. 45°
1½ elbow "
1½ flange union
" 45° elbow
bushings to reduce from 1 to 3/4
reduce from 1 to 3/4

2 reduce from 3 to 1½
10. 1" Elbows
3. 3/4 wrought iron bends
1. 1½ p sag
2. 1" "
2 elbow 1" nipple
4 " 3/4 coupling

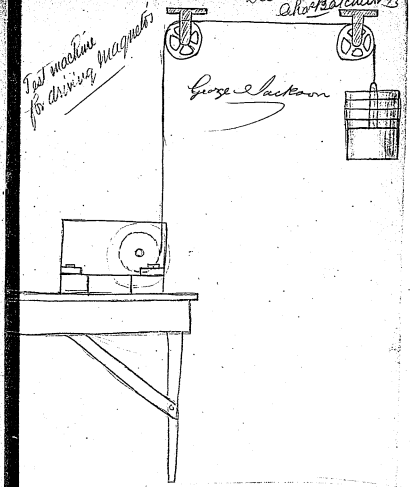



1 1/4
upright 1 1/4 15 ft 4"
Height 3 f. 10 flour flour
5/8
5/8
1 1/4
23 ft 3"
3/4
1"
Same as the other upright

Dec 20 1895
Short Stitch 23

Test machine
for driving magnets

George Jackson



Diameter of inside of cylinder.
5·0625 inch

~~Length~~ of Tube ~~and~~ fire 16·29 inch
over lap about 1 5/16 inch

Bend first round cylinder of smaller diameter so as to have the overlap at contact & rivet it up so that it will not quite go on the finishing cylinder then heat & put on the finishing cylinder & let cool

a Daniells cell over one Siemens will decompose in one second .108 Mlgr H_2O

.108 Mlgr

E.M.F Daniells 1.17

Resis Siemens .9730

1.0493

log	.108	7.0334
comp log	1.17	9.9318 — 10
log	1.0493	0.0210
		2.9862

.0969 Mlgr 1 Volt

over 1 Ohm of H_2O

1 Weber

1 Farad one second

.0969 Mlgr

The determination of Weber show that a current having the intensity of one decomposer in one second .009376 Mgr. H_2O

or .000009376 Grammes

D : 11.6

.0092 Grammes

.00092 Grammes

~~.00092~~ Mllgr

.92 Mllgr

.092 Mllgr $\frac{1}{10}$ Daniells

Calculated from Weber

pp 425-29.

.096 Mllgr

~~A Daniells cell~~

The chemical unit of E.M.F.

is a force sufficient over one

Siemens to decompose 1 Mllgr

of H_2O

E.M.F. in ch. units of a Daniells

log .01204 $\bar{2}.0808$

$J = \frac{1}{830}$ 2.9192

A current which decomposes a

Mllgr of H_2O in one second

has an absolute (Weber's unit)

950.

There is given off

101.92×10^3 metre-grammes of heat in one second by one Ampere of current over one Ohm. Latimer Clark, p. 10

.00336 Grammes of zn burned

to give off this amount, as burned in a Daniells cell which gives in this combination 714 gm deg C per gramme

.00336	$\bar{3}.5263$
714	2.8537
425	2.6284
log 1.17	9.9318 − 10
	2.9402

872.

log 1019. 3.0084

Work

101.92×10^3 Metre grammes

$= 10192. \times 10^3$ Centi grammes

$101.92 \times 10^3 = 1.0192 \times 10^4$

4156×10^4	7.6186
714	2.8537
.00336	$\bar{3}.5263$
	~~7.6000~~
	7.9786

42500	4.6284
981	2.9917
	7.6101.

4175×10^4

.00846

714

In the E. B Vol. VII p. 105 is given a table of the amount deposited of the various elements by a unit of current, one Weber in one second. The table is based on the assumption ~~so called~~ that the amount of H_2O decomposed by one CGS electromagnetic unit of electricity, is .00093 gramme ~~in the Laboratory~~ quoting as authority Weber, Joule, Palmer, Casselman, and Kohlrausch and citing Wied. Gals. Bd. III S. 1077-1079

The value of Cu on the authority of Faraday for the equivalent is given as ~~.00320~~ .00328. A unit of current is ~~[illegible]~~ slightly less than that given by a Daniells cell on a circuit of one Ohm. ~~[illegible]~~ It is this very easy to obtain a proof of ~~[illegible]~~ the numbers in the table. For example Wiedemann states on the authority of Raoult that a Daniell's cell on a circuit of one Ohm deposits 0.377 Milligr ~~[illegible]~~ ~~[illegible]~~ 0.003 That is ~~of~~ Daniells ~~[illegible]~~ an E.M.F.

The Volt being ~~1/x~~ Daniell

The amper being x Ohm

	0.377	T.5763
comp	1.11	9.9431 -10
comp	1.049	9.9881 -10
		1.5075 -10

.321 Milligr

.0032 Grammes

of .1.14 Volts and

a Siemens being 0.973 Ohms

the amount deposited by a Weber

in one second is

$$\frac{0.377 / .973}{\cancel{1.14 \times .973}} = \cancel{.340 \text{ Milligr}}$$

$$= \cancel{.00034 \text{ Grammes}}$$

	T.5763
	9.9431 -10
	10.0119 -10
	T.5313

which is about one tenth of the quantity in the Table.

~~In referring to~~ Wiedemann

refers in the reference cited

by the Encycl. Brit. §

Bd II §1077

that a Weber's unit of current
that is the current in a element of
~~[illegible]~~ 10^{10} ~~[illegible]~~ ~~[illegible]~~ ~~[illegible]~~ ~~[illegible]~~
containing an E.M.F. of
$10^{10}\ \frac{Mm^{\frac{3}{2}}\ Mgr^{\frac{1}{2}}}{Sec^2}$, will decompose
in one second .00933 Mlgr.
1 Volt is $10^{11}\ \frac{Mm^{\frac{3}{2}}\ Mgr^{\frac{1}{2}}}{Sec^2}$ or $\frac{1}{10}$th
times ~~as~~ greater ~~as~~ Weber's unit,
so that it would ~~deposit~~
decompose .0933 Mlgr.
in one second, or .0000933
~~Mlgr~~ Grammes, again the
tenth of the amount given in
the Encyl. Brit.

Kohlrausch ~~of~~ gives as
the amount of Cu deposited in one

second by a Weber's unit of current as

$$\frac{1.991}{60} = .0332 \text{ Milligr.}$$

~~Webers~~ or by one ~~Weber~~ .332 Milligr.

.000 332 Grammes one tenth of the value given.

Some results as to the E. M. F. of a Daniells are deduced in the Encycl. Brit. seemingly on the authority of Sir William Thomson pp. 84-85. From the equation $\mathcal{E} = g e \Theta$

$g = 4156 \times 10^4 \; \underline{c} \; \underline{g} \; \text{Sec}$

$e = .003411$ for Gm on the authority of Kohlrausch

$\Theta = 734$ (gm. deg. C.)

The result ~~[illegible]~~

$$4156 \times 10^6 / .003411 \times 734 = 1.042 \times 10^8$$

from ~~[illegible]~~ which is deduced that the E. M. F. of a Daniells is 1.042.

~~1.042 × 10^8 C.G.S. expresses the amount of heat in absolute measure from given off by from one Ohm when the total circuit is, if 1.042 expresses the E.M.F. of a Daniells 1.042 Ohms.~~

1 ~~Wost~~ Weber should give off on one Ohm according to this resistancy 10^8 C.G.S. units of heat in one second. In Clark and Sabines Elec. Tables and formulae this ~~[illegible]~~ ~~Dalmeni Clark~~ gives ~~[illegible]~~ amount is given of ~~work~~ as $10^3 \frac{gr\ m^2}{sec^2}$ or $13740^3 \frac{gr\ m^2}{sec^2}$ which is again 1/10 of the figures in the article.

The error is of course repeated several times. Jenkin in his book on electricity and magnetism makes the same error and gives a table which seems to have very little relation to the ~~quantities~~ Electrical equivalents of

~~Sorry more, be [illegible]~~

~~[illegible]~~

Yours Truly
Francis R. Upton

Menlo Park N.J.
Apr. 1879.

1/2 Ohm magnet

To give an idea of the efficiency of a Thermo as against a Calland working on 1/2 ohm resistance.

Given a thermo say of 20 elements equal in E.M.F. to one Calland cell.

If Resistance Calland = 2 Ohm
" Thermo = 2 "

Then $C = \frac{E}{R+r} = \frac{1}{\frac{1}{2}+2} = \frac{2}{5}$ in each

If Resistance Thermo = 1 Ohm

then $C = \frac{1}{\frac{1}{2}+1} = \frac{2}{3}$ $\quad \frac{2}{3} \times \frac{5}{2} = \frac{5}{2}$

$1\frac{2}{3}$ times more current than from Calland.

If Resistance Thermo = $\frac{1}{2}$ ohm

$C = \frac{1}{1} = 1$

$2\frac{1}{2}$ times more effective

If Resistance Thermo = $\frac{1}{4}$ ohm

$C = \frac{1}{\frac{1}{2}+\frac{1}{4}} = \frac{4}{3}$ $\quad \frac{\cancel{4}^{2}}{3} \times \frac{5}{2} =$

$3\frac{1}{3}$ times more effective.

If Resistance Thermo = $\frac{1}{8}$ ohm

$C = \frac{1}{\frac{5}{8}} = \frac{8}{5}$ $\quad \frac{\cancel{8}^{4}}{\cancel{5}} \times \frac{5}{2}$

4 times more effective.

If Resistance Thermo = 0

$C = 2$ $\quad 2 \times \frac{5}{2} = 5$

5 time more effective

$$\mathcal{E} = \frac{\mathcal{E}}{R}$$

$$W = \frac{\mathcal{E}^2}{R} = C\,\mathcal{E}$$

$$\frac{\text{Mllgr}^{\frac{3}{2}}\ \text{Mm}^{\frac{1}{2}}}{\text{Sec}^2} \quad \text{Mllgr}^{\frac{1}{2}}\ \text{Mm}^{\frac{1}{2}}$$

$$\frac{\text{Mllgr}^2\ \text{Mm}}{\text{Sec}^2} = \text{Agr W}$$

Statvolts

$$a = 10^7 \qquad 10^4$$
$$= 10^{12} \qquad 10^7$$
$$= 10^{11} \qquad 10^2$$

.03411 Mllgr

714

4155

10^6

$\frac{\text{Mllgr. Mm.}}{\text{Sec}}$

10, 12 $\times 10^{10}$

1.012 $\times 10^{11}$

4156 3.61855 $\frac{\text{Gr C}}{\text{Sec}}$

104 4.

734 2.86657

.00341 3.53228 Grammes

8.0170

.00341

.0341

$\mathcal{E} = \mathcal{I}\mathcal{E}$

$(L^{\frac{1}{2}} M^{\frac{1}{2}})($

$(L^{\frac{1}{2}} M^{\frac{1}{2}})\left(\frac{L^{\frac{3}{2}} M^{\frac{1}{2}}}{T^{2}}\right)$

$A = a\,z\,\mathcal{I}\,W$

$\mathcal{I}$, here is a number

~~one~~ W is pressed the ~~work as~~ ~~one~~ heat evolved by burning one ~~equiv~~ unit of Zn

$z\mathcal{I}$ expresses the ~~one~~ equivalent consumed

a Joules equivalent

$z\mathcal{I}$ z is the amount of Zn decomposed by a unit of current

$\mathcal{I}$ is the number of units of current passing

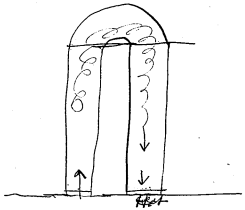
$\mathcal{I}$ is simply a numeral

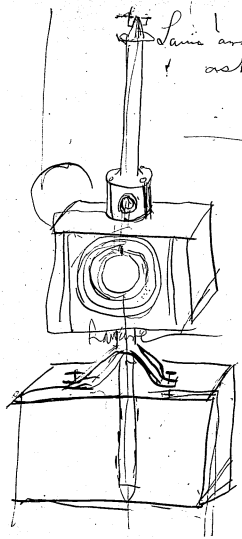
$\mathcal{I}\mathcal{E} = a\,z\,\mathcal{I}\,w$

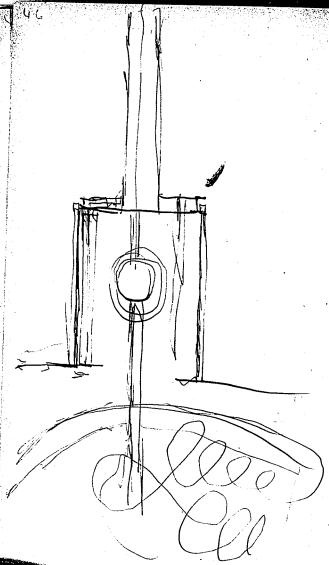
this equation is not wholly true

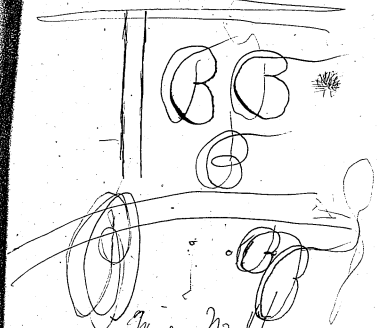
$\mathcal{I}\mathcal{E} = a\,z\,i\,w$ i a numeral

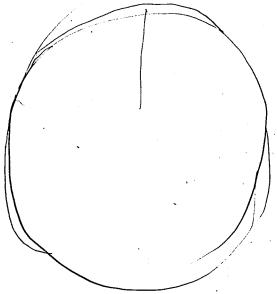
$\mathcal{I}\mathcal{E} = a\,z\,i\,w$




basic arrangement
of the
magnet




Wire No
Draw the Aluminum
wire to the



~~39.475~~

31.415 Centimeters

31.415	1.4970
18.	1.2553
	2.7523

5.65 Metres

14mm

5.65	0.7523
.0375	$\bar{2}.5740$
	$\bar{1}.3263$

.212 Ohms

1 foot

50

17.72

886. Ohms

1500

40

~~40~~

~~1600~~

$\frac{1}{25}$

$\frac{1}{25} = \frac{2}{64}$

$\frac{64}{25} =$

25) 64 (2.5

140

$\frac{2}{64}$

Buff paragraph II 1.08 g. W.G.
Daniells
liberates in one second through
1 Siemens
.0116 Mllgr. H

Raoult II 1.060 W.G.
Daniells 1 Siemens 1 second
.377 Mllgr Cu.
.108 Mllgr water
.012 Mllgr H

1.074 II W.G.
Mhm = 1.0193 Siemens

Kohlrausch II 1.080
1 second mult. of current
.11363 Mllgr Ag
.009476 Water

~~Fogg~~ Casselman, Bunsen & Weber, using two galvs and measuring horizontal intensity of the Earths magnetism at the same time
.009421 Mllgr Water
Electro chemical equivalent of water

E. M. F. of Daniells
= 11.07
11.08 E.M.F. Kohlrausch
10.25 Bosscha

1000
10 10

1000
10

$\sqrt{10}$ $10\sqrt{10}$

$1000\sqrt{10}$

$\sqrt{10}$ $10\sqrt{10}$ 10000

$\sqrt{10}$ $1000\sqrt{10}$
$1000\sqrt{10}$

$10\sqrt{10}$
$1000\sqrt{10}$

10000000

100000

$10\sqrt{10}$

$10\sqrt{10}$

1000

$L^{\frac{3}{2}} \cdot M^{\frac{1}{2}}$

$1000\,mm = 1\,m$

L^{3}

$(10\sqrt{10})^{3} = 1000\sqrt{10}$

$10\sqrt{10} = 10\sqrt{10}$

$10^{6} \times 10^{5} = 10^{11}$ $1{,}000{,}000$

$(10\sqrt{10})^{3} = \sqrt{10}$

$\cancel{= 1000\sqrt{10}}$

$\cancel{= 10\sqrt{10}}$

Cm $\sqrt{10}$

10^{3} $10\sqrt{10}$

$10\sqrt{10}$

1000 10^{3}

$100\sqrt{10}$

$10^{8} \times 10^{3} = 10^{11}$

$$\frac{Cm^{\frac{3}{2}}\, Gr^{\frac{1}{2}}}{Sec^{2}} = 1000\,\frac{Min^{\frac{3}{2}}\, mg^{\frac{1}{2}}}{Sec^{2}}$$

$Cm = 10\,mm$

$Cm^{\frac{3}{2}} = 10\sqrt{10}\,mm^{\frac{3}{2}}$

$Gr^{\frac{1}{2}} = 10\sqrt{10}\,mg^{\frac{1}{2}}$

R. E

$J = 4156 \times 10^4 \ \frac{Gr \ Cm^2}{Sec^2}$

$J = 4156 \times 10^9 \ \frac{Mg \ Mm^2}{Sec^2}$ 1000 100 1000

.000

W. G

$J = 4156 \times 10^6 \ \frac{Mg \ Mm^2}{Sec^2}$

.03411 ~~Grammes~~ Mlgr

.00003411 ~~Mlg~~ Gramme

.0003411

Wber .03411 Mlgr

3.411 Gramm

.03411 Mlgr

.00003411 Gramme

.0003411 since Webess unit = 1/10 Volt

Volt deposits when on resistance of 1 Ohm

.0003411 Gramme Zn or uses it in battery

$\frac{m^{\frac{1}{2}} L}{T^2} \ \frac{L}{T}$

Mg mm

$\frac{m^{\frac{1}{2}} L^{\frac{3}{2}}}{T^3}$ $\frac{m L^2}{T^2}$

$m^{\frac{1}{2}} L^{\frac{1}{2}}$

$m^{\frac{1}{2}} l^{\frac{1}{2}}$

$E.M.F. \quad \frac{m^{\frac{1}{2}} l^{\frac{1}{2}}}{T^2}$

$= \quad 10\sqrt{10}$

$\sqrt{10}$

100

10^6

10^4

.00341 Gramme

00 3,41 Mlgr

.31

.003411 Mlgr

.3

.341

.03411 Mlgr

1.000

C G S

$$W = (10^{-1})^2 (10^9) = 10^7$$

$$\left(10^{-1} \frac{L^{\frac{1}{2}} M^{\frac{1}{2}}}{T}\right)^2 \left(10^9 \frac{L}{T}\right)$$

$$= 10^9 \frac{L^3 M^1}{T^2} = 10^7 \frac{C^{\frac{3}{2}} L^{\frac{1}{2}}}{S_{ec}^2}$$

$10^7 \frac{C^{\frac{3}{2}} L^{\frac{1}{2}}}{S_{ec}^2}$ = amount of heat given off in one second by one Weber on one Ohm

10^7

1 Daniells cell deposits Ag. Raoult

.377 Mllgr of Cu in one second when the total resistance of the circuit is one Siemens unit

Daniells has E.M.F. = 1.07 Volts
Latimer Clark

Siemen unit = .973 Ohms

.377	T. 5763
.973	T. 9881
Comp 1.07	9.9706 − 10
	9.5350 − 10

.343 Mllgr. in one second by 1 Volt in 1 Ohm

.0003439 Gramme

D = 1.07 Volts

7.9851

9.9706

9.9587-10 Constant for

Water .108 1.0334 change from Daniells over Siemens

7.9921 to Volt over Ohm

.0982 Mllgr Water per second 1 Volt over 1 Ohm

~~7 .0099~~

.012 Mllgr H in one second from one Daniells

.00947 Mllgr Water decomposed by Weber's unit of current.

$$\Sigma = 10^{10} \frac{M^{\frac{3}{2}} M^{\frac{1}{2}} Mllgr}{Sec^{-2}}$$

This shows that a Weber's unit of E.M.F. is 1/11 of a Volt

.0120, Mllgr ~~H~~

$$\frac{.012}{1.0493 \times 10^{-10}} \times 957$$

$$\frac{.012 \times 957}{1.0493 \times 10^{10}}$$

1 Ohm = 1.0493 Siemens

10^{10} = 1.0493 Siemens

$$\text{Siemens} = \frac{1 \cdot 10^{10}}{1.0493}$$

4 Ohms outside.
1. Ohm inside

4 lamps cost of one Ohm how many Ohms can be put in one lamp?

$W = \frac{C^2R}{R} = \frac{1}{4}$ on each lamp

$\mathcal{E} = \cancel{\frac{C}{R}} = \cancel{C^2R}\ \frac{C}{R}$

$\cancel{W = \mathcal{E}C}$

$W = \frac{\mathcal{E}}{R} = \frac{\mathcal{E}}{R}$

$16 \quad \frac{\mathcal{E}}{R} = 1 \qquad 4$

$16 \quad \frac{\mathcal{E}}{R} = 1$

$\underline{16} \qquad \frac{1}{4}$ current

$\frac{4}{16}$ ~~1/4~~

1 Ohm in machine

$$W = c^2(R+r)$$
$$= c^2(4+1) \qquad \mathcal{E} = 1$$

in each lamp

$$W = \frac{c^2(4+1)}{5} = \frac{\mathcal{E}}{R}$$

$$c = \frac{\mathcal{E}}{(R+r)} = \frac{1}{25}$$

$$W = \frac{1}{25}$$

$$W = \frac{1}{5} \qquad W = \frac{c^2(4+1)}{5}$$

$$W = c^2 = \frac{1}{25}$$

$$c = \frac{\mathcal{E}}{R}$$

$$W = \frac{\mathcal{E}^2}{R^2} = \frac{1}{25}$$

$W = \frac{1}{25}$ on each lamp

$$c = \frac{\mathcal{E}}{(R+r)}$$

$$W = \frac{1}{25}$$

$$\frac{1}{25} = \frac{\left(\frac{1}{R+1}\right)}{\cancel{R}} \frac{R}{R+1}$$

$$= \frac{R}{(R+1)^2}$$

$$R^2 + 2R + 1 = 25R$$

$$R^2 - 23R = -1$$

$$R^2 - 23R + \left(\frac{23}{2}\right)^2 = \left(\frac{23}{2}\right)^2 - 1$$

$$R - \frac{23}{2} = \sqrt{\left(\frac{23}{2}\right)^2 - 1}$$

$$R = \frac{23}{2} \pm \sqrt{\left(\frac{23}{2}\right)^2 - 1}$$

$R = 15$. Ohms

$$\begin{array}{r} 2\overline{)23} \\ 11.5 \\ \hline \sqrt{10.5} \\ = 3? \end{array}$$

$$\begin{array}{r} 11.5 \\ 3.6 \\ \hline 151 \end{array}$$

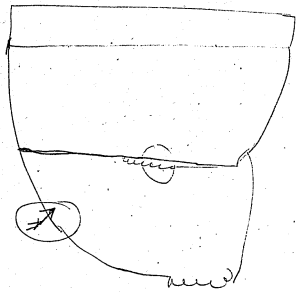
$$\text{Work} = \frac{m\,l}{t^2}\,\frac{l}{t}\,t$$

$$= \frac{m\,l^2}{t^2} \quad \text{Watts over Ohms}$$

$$= 10^7\,\frac{\text{Cm}^2\ \text{Grams}}{\text{Sec}^2}$$

$$10^7$$

$$.00101\,7$$



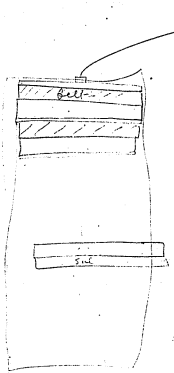
18 Ohms by the method of halfing the center

18 Ohms outside

360 = D

0 Ohms outside

185 = D


Bell
Bell

Determination of ~~Gramme~~ Machine running 1060 Revolution per minute

Galvanometer

A cell composed of Zn amalgamated, neutral solution of sulphate of Zn., porous cup, neutral solution of Cu. electrotype Cu.

This is the standard ~~for~~ given by Wiedemann and its E.M.F. is about 1.09 Volts

Three ~~other~~ cells of Gravity are compared and the total deflection obtained from the four.

The galvanometer is then shunted to bring the ~~readings~~ deflection from the four to about 50 on the scale

Then the E.M.F. from the Gramme is taken over an measured resistance. Measured when hot, From this the Current is calculated and compared with the deflection on the dynamometer.

The constant of the Dynamometer can then be calculated. It is the deflection for 1 Weber.

The square root of the ~~quotient~~ of this is the unit division, to divide ~~the~~ The square root ~~[illegible]~~ of the ~~[illegible]~~ of any other deflection ~~[illegible]~~ to obtain the number of Webers.

The galvanometer

standard cell	200 L
No. 1	180 L
No. 2	180 L
No. 3	180 L

Total brought down to 50

60 = 4 in circuit

Fidrind 1' L

12° 10' = Dynam

22 D = D

over 1.1 Ohms

5 Ohms in total circuit

$\frac{220}{50} = 4.4$

3 Gravity = 2.7 Standard

2.7 + 1. = 3.7 Standard

3.7 X 1.09 Volts 50 Ω

$\frac{3.7 \times 1.09 \times 220}{50} = V_o$ Cts

0.5682
0.0374
0.6435
1.2491 17.4 Volts

Com

over 1.1 Ohm

17.7 1.2491
1.1 0.0414
1.2077

16.1 Webers

CR = E

16.1 X 5 = Volts in all

80.5 = Volts in all

Sort lbs

16.1	1.2077
16.1	1.2077
5.	0.6990
44.	1.6435
	4.7579

57.200 ft lbs of Elec.

Dynamometer

12° 10' 2 1.3237 −10

1.2068

Webers 16.1

Constant 2.4550 .0285

Book 17, p. 144 2.4249 .0266

This is too large an error i. e. must go over the readings more times

1.5441
1.8751
3.4192

73
5.2 5

2620m

Again

	Standard	200
No 1		179
No 2		181
No 3		180 avg

3.7 Daniell . 50 = A to left

3.7 X 1.09 Volts

50/30.7
6.14

0.5682
0.0374
6.14 .7882
1.3938
.0719
1.3219

24.7 Volts
1.18

21.1 Webers over circuit

No current 75 Ohms

A = 307 1.18 Ohms

Dy 21° 19'

see p. 86

Total 3.8 Ohms

21.1 1.3219
3.8 .5798
79.8 Volts 1.9017

2 (9.5605
4.7802 − 5
21.1 1.3219
$\bar{3}$.4583 − 5
$\bar{2}$.4583

Constants
Ayrtons

25/50 = 1.5

3.7 0.5682
1.09 0.0374
1.5 0.1761
.7817 6.05 Volts

E.M.F. when current opened

305 Again — 1060 revs.

3.95 Ohms total

19° 56'

R = 1.99 Ohms

3.95 Ohms total

19° 56' = 1.95323 − 10

4.7661 − 5

1.3219

3.9442 − 5 webers

2.9442 − 21.1

2.4550 161.1

2.4583 21.1 Volts

2.4249

3.95 × 1.3219 = 1.9125

21.1

82.9 Volts

Constants

I take 2.4500

This being safe and probably near the truth.

Transmission 1060 revs.

Again 6.1 Ohms total

8° 13'

total . 6.1 Ohm

8° 13' = 9.1550

Probably Volts.

2.5000

6

5.1275 − 5

1.3275

.8261

1.9536

13.4 Webers

6.1 Ohms

89.8 Volts

Probably too much

The same

8° 29'

6.1 Ohm total ✓

8° 29 . 9.1658

4.5843 – 5

2.4500

6.1343

1.1342 13.6 Webers

6.1 .7853

1.9196

83.1 Volt

6° 4'

8

New Machine W = 85 m

10° 18' + 2'

8 Ohms Total

10° 20' 9.2537 – 5

4.6228

2.4500

15.0 Webers 1.1768

8 .9031

1.2799

120 Volts

12° 12'

6.34 Ohms

9.3267
4.6433
2.4500
1.1133 12.9
6.34 .8021
1.9154 82.3

15 volts 1.1768
1.1768
.9031
1.6435
4.9002

79000
66
13

2½ H.P. 8 Ohms in circuit

11° 30'

~~50 Ohms~~
25 Ohms about
15 Ohms "
12 Ohms —
10 "
7 "
6 .5 —

40 amell D = 50

About 50 Ohms in circuit

D = 10
10
50

$\frac{4}{5} \times 1.09$ Volts

4. .6021
.218 T.0385
.79406
.20417
1.7365
50 1.6990
1.4355

on 1.6 Ohms

.545 Webers

27.2 Volts on circuit

After bringing up magnet

544 Volts

D = 20

Circuit open 105 = D

$\frac{105}{50} = 2.1$
4
8.4 .9243
1.09 .0374
.9617

9.75 Volts

About 20. Ohms in circuit before bringing up magnet

26

on 1.6 Ohms

after 41 = D

on 1.6 Ohms

$\frac{26}{50} = .52$ T.7160
4. 0.6021
1.09 0.0374
.3555
1.6 .2041
1.4 Webers .1514
1.4771
1.6285

42.6 Volts on circuit

$\frac{1}{50} = .02$ $\bar{2}.3010$
4. .6021
1.09 .0374
$\bar{3}.9405$ Constant
41 1.6128
$\bar{0}.5533$
.2641
$\bar{1}.3992$
1.4771
1.8263

67.1 Volts on circuit

~~Ohms~~ 20.5 Ohms Total

on 1.6

Fiducial 5' to right
42
47'

The 10 ohm spool well warm

76	$\bar{2}.9405$	
	.8858	
	.8212	6.6 Volts
	.204	
	.6172	4.14 Volts
20.5	1.3118	
	1.9290	84.9 Volts

47' | 8.1354
4.0679
.6172
3.4507
$\bar{2}.4507$ Constant

11.2 Ohms total

195 on 1.63 Ohms

4° 24' + 4 4° 28'

Current sufficient to jump across the plug

195	$\bar{2}.9405$	
	2.2900	
	1.2305	
1.63	.2122	
	1.0183	10.4 Volts
11.2	1.0492	
	2.0675	116 Volts in current

8.5914
4.4257 -5
1.0183
3.4297
$\bar{2}.4271$

10.2 Ohms Total

D = 225 or 1.67 Ohms

5° 30'

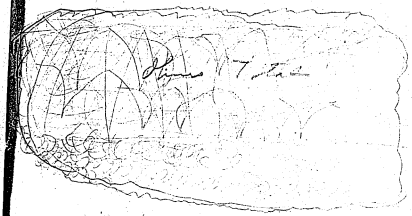
$\bar{2}.9405$
2.3522
1.2927 19.4 Volts
0.2227
" 1.5080 11.2 Webers
10.2 1.0086
2.0586 Volts
114 Volts

9.0070 - 10
4.5035 - 15
1.0500
3.4535
$\bar{3}.4535$ constant

7.25 Ohms Total

10° 30'

9.2626
4.6313 - 5
2.4500
1.1813 15.1 Webers
7.25 .8603
2.0416 111 Volts



Gramme 1040 rev

6.74 Ohms Total

5° 40'

8.9945

4.4972

2.45 00

11.1 Volts 1.0472

674 .8257

75.9 Volts 1.8759

8° 43'

5.77 Ohms Total

9.18 05

4.5902

5.85 00

1.1402 13.8

5.77 .7612

1.9014 79.6 Volts

5.3 Ohms Total

11° 23'

9.2952
4.6476
2.4500
1.1976 15.7 Webers
.5.2 .7243
83.5 Volts 1.9219

4.95 Ohms Total

12° 42'

9.3421
1.6710
2.4500
4.95 .7221 16.6 Webers
.6946
1.9286

84.3 Volts V

4.25 Ohms Total

17° 54'

4.22 Ohms

9.4876
4.7438
2.4500
4.23 1.2938 19.6 Webers
.6263
83.2 Volts 1.9201

22° 9'

3.75 Ohm Total

9.5763 .10
4.7881 .5
2.4500
1.3381 21.7 Webers
3.75 .5740
1.9021 79.8 Volts

Grammer 1040

25° 2'

8.5 Ohms total
3.6

25° 2'

9.6264
4.8132
2.4066
1.3632 23.6 Webers
3.55 .5502
1.9134

81.9 Volts

1.3632
1.3632
3.5 0.5441
442 1.6458
4.9159

82.400

Result Grammer 1040 105-
mm

	Ohms	Volts	Webers	
p.100	6.74	75.9	11.1	Hr 14.0
p.90	6.1	83.1	13.6	8.47
p.101	5.77	79.6	13.8	5.65
p.107	5.3	83.5	15.7	
p.102	4.95	84.3	16.6	
p.103	4.22	83.2	19.6	
p.88	3.95	82.9	21.1	
p.87	3.8	79.8	21.1	
p.103	3.75	79.8	21.7	
p.104	3.55	81.9	23.	1.9
	3.5	82.7	23.6	
	2.92	79.4	27.2	
	2.32	68.7	29.6	
	5.25	69.1	12.2	
p.	4.4	75.8	16.2	
	2.7	59.8	22.	
p.20	4.1	84.2	20.5	

~~New Machine 840 revs.~~

~~Cross~~

36° 20'

3.5 ohms total

(9.6469
4.8234
2.4500
1.3724 23.6 Weber
3.5 .5441
1.9175 Volts
82.7

36°

2.92 ohms total

2 (9.7692
4.8846
2.4500
1.4346 27.2 Webers
2.92 .4654
1.7000 79.4 Volts

44° 10'

2.32 ohms 1.4715

(9.8430
4.9215
2.4500
1.4715 29.6 Webers
2.32 .3655
1.8370 68.7 Volts

87.900 Volts

New Faraday Dynamo on Field

2° 57

15.35 Ohm

8.7115

4.3557 -5

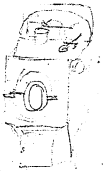
2.4506

0.9057 8.05 Webers

15.35 1.1860

2.0917

123 Volts



Gramme Machine.

The next to the largest shoulder
To determine its constant

Standard cell	200
Daniell's extremely well separated	193
No. 2	193
No. 3	.193
	2)7.79
	3.89

4 cells 50 = D
4° 41'

91 = Q

over .73 Ohm

3.89 .5899
1.09 .0574
4.23 Volts .6273

Sp 91

2.82	.2601	
4.23	.6273	
Comp .73	10.1367	
	1.0241	

10.5 Webers

2)8.91.19
4.4559
10.5 1.0241
3.4318
2.4318

15° 48 No resistance

183 = D over

18° 30' 1/2 Ohm coils assuming

~~196~~ 204

19° 30'

207

19°.40' about 80

5.0|204
14.08

.6273
4.08 .6107
.80 10.6969
1.2349 21.6 Webers

2|9.5126
4.7563
1.3349
3.4214
$\bar{2}$.4214

14° 55

225 = D

R = .99 Ohms

.6273
.6532
5.0|225 .0044
4.5 .99 1.2849

19.2 Webers

9.4106
4.7253
1.2849
3.4204
$\bar{2}$.4204

$\bar{2}$.4318
$\bar{2}$.4214
$\bar{2}$.4204

avg $\bar{2}$.4250

10° 3.91

4.22 Ohms

42

18° 1.0

3.13 Ohms

20°45' = D

2.055 ohm

23° 16'

2.15

22° 16'

$\frac{R'+R''}{R'R''} = \frac{2}{R}$

$R = \frac{R'R''}{R'+R''}$

$R = 10\Omega$

$\frac{10}{10'} = \frac{10}{10'}$

1060 revs

Belt slipped badly

21° 30'

1.7 Ohms Total

log of sines

1.3570
1.3570
.3804
.6454
3.5708 ~~[illegible]~~

9.5640
4.7820
2.4250
6.3570
1.3570 22.7 Webers

1.7
.3204
1.6874

48.6 Volts

Belt slipped

The dynamometer did not do well ~~think~~ it is placed so that the earths magnetism affects it. ~~[illegible]~~ Perhaps the longer wire running slow

25°, 40'

1.55 Ohms

log of sines

~~1.3933~~
~~1.4283~~

2.9.6366
4.8183
~~[illegible]~~ 2.4250
1.3933 24.7 Webers

This does not agree in the least with results previously obtained

4.8183
2.3771
1.4412
1.4412
1.55 .1903
44. 1.6435
4.6762

27.6 Webers

Say 30

1.4771
1.4771
.1903
1.6435
4.7880

61.200 ft. lbs.

49,600 ft. lbs

Do not understand will investigate

150 L

19°

.53 Ohm

4.23
3
12.69 1.1035
.53 $\bar{1}$.7243
1.3792

23.9 Webers

19°

9.5126
4.7563
1.3792
3 3 7 7.1
$\bar{2}$.3771

Orig 3 Ohms total

1.3792
3 1.3792
.4771
.6454

152 = D on .53 Ohm

19°38'

2.8 Ohms Total

.53 Ohms

1.3792
19°38' 9.5263
4.7631
1.3792
3.3939
$\bar{2}$.3939

1.3792
1.3792
2.5 0.4472
44 1.6435
4.9491

70.600

70.600 ft. Ans.

next page

4 Daniells April 10

50 L

4.9 R

4 lamps 1.137 .80 Ohm

3 circuits

4
3) 3.20
1.06 Ohm

1/2 machine 706 ft. lbs.

35300 4.54.8
12 1.0000
3.4586
.161
2.2925

2940

15 candles

196 ft. lb. per candle

15 candles to Camp

175 =

on .95 Ohm

10° 17'

3.65 Total

50) 175
3.5
4.23
Comp .95

.5441
.6263
10.0223
1.1927

15.5 Webers

10°17'

9.2576
4.6258
1.1927
~~8.865~~
3.4331
2.4331

.195 = Ω

11° 57' .92 Ohms

50) 1.95
3.9

) 1.95
3.9

3.9
4.23
comp .92
18. Webers

.5911
.6263
.0322
1.2536

2) 9.3160
4.6580
1.2536
3.4044
$\bar{2}$.4044

10.9 = Ω

2° 5' 1.23 Ohms

50) 10.9
2.18
4.23
comp 1.23

.3385
.6263
9.9101 − 10
.8749

7.5 Webers

2° 5'

) 8.5605
4.2802
.8749
3.4053
$\bar{2}$.4053

180 = D

5° 20'

1.24 Ohm

57/150

3.6 .55563

4.23 .6263

Comp 1.24 9.9066

1.5892

12.2 Webers

8.9682

~~1.5892~~

4.4841

1.0892

.3949

$\bar{2}.3949$

210 = D

1.27 Ohm

10° 51'

57/210

4.1

4.2 .6332

4.23 .6263

Comp 1.27 .8962

.10

.5

1.15

1.1557

14.3 Webers

9.2432

4.6216

1.1557

1.4659

2.4449 Constant

13° 35'

1215 = D

.91 Ohm

4.3 .6335

.6263

Comp 10.0410

20 Webers 1.3008

2.9.3708

40664

13446

33856

$\bar{2}.3856$

On lamp

4° 40'

5° 18'

4.2 Ohms

D.

.88 1.67
88
.79 Ohm

D = 230 R

230 1.67

~~50 230~~
4.6 .6628
4.33 .6263
1.2891
1.67 .2227
11.4 1.0664

1.0664
1.0664
.79 1.0776
.44 1.0550
3.6739

4720 33,000 4.5185
3.6739
.8446

6.9 Lamps per H.P.

114 = D

.93 Ohm

210 = D

114
2.28

2.28 .4440
4.23 .6263
Conv. .93 10.8 3.15 1.69
1.1018 .93
.76

3579

50)200
4.2 .6232
4.23 .6263
1.2495
1.69 .2279
1.0216
1.0216
.76 . 1.8808
44 . 1.6435
3.5675

3700

3700 4.5185
3.5675
.9510

9 per = P

120 4° 40'

120 = D over .95 Ohm

200 = D

4.23
16.92

3100

1.58
.95
.63 Ohms

1.2279
.1987
1.0292
63 1.0292
40 1.7993
1.6435
2.5612

155
155 = D

1.2 ohms 4°57'

250 = D

1.91
1.55
.46 ohms

5) 155
3.1

amp 1.2) 1.4914
423.6263
9.9208 - 10
1.0385

10.9 webers

4°57 2) 8.9359
4.4679
1.0385
3.4294
2.4794

The gem point had changed

Tried to determine the amount H.P. used the pressure of the lamp being determined by substitution M.G. as the field of the magnet did not make in the same way.

3° 30' Quite fair determination

.76 Ohm

2 (8.7856
4.3978 - 5
2.4000
.9978

9.95 Webers

.9978
.9978
.75 T,8751
44.2 1.6454
3.5161

3.280
Ohms 4.5185
3.5161
1.0024

10. Per H.P.

Lamp bright yellow white

.77 Ohm

4° 2'

(8.8471
4.4235
2.4000
1.0235
1.0235
.77 T,8565
44.2 1.6454
3.5789

3800.

4.5185
3.5789
.9396

8.7 per H.P.

This is somewhat too small as I did not deduct enough for leading wires

May 10 New machine on 3rd cone from end 1185 revolutions.

Standard Daniells 200
on 1 196
3.88

200
3.94
4 | 7.88 200 | 17.88
7.97 3.94 Daniells

3.94 .5955
1.09 .0374
.6329

4.29 Volts

50 = D for 4 Daniells

72 = D

2° 27'

on .76 Ohm
derivation

5.072
1.24
4.29

.0934
.6325
comp. 0.76 10.1192
.8451

7.0 Volts

8.6309
4.1354
3.4955
3.4703
2.4703

~~13.0 = D~~

~~.92 Ohms~~

~~3° 47'~~

175

1.10 Ohms

6° 33'

8.2 Ohms total

50 / 1.75

3.5	.5441
4.29	.6325
comp 1.10	9.9586
13.5 Webers	1.1352

Constant

2.3933

9.0571
4.5285
1.1352
3.3933

~~175~~

~~May 9~~ P.M.

50 = D 4 Danielle

179

1.08 Ohms

6° 22'

50 / 179

3.58	.5539
5.29	.6325
comp 4.08	9.9666 −10
14.2 Webers	1.1530

9.0449
4.5224
1.1530
3.3694
2.3694

180

1,12

6° 12'

50 | 180
3.6
4.29 / 1.12 9.9308
13.7

.5563
.6325
1.1396

2 | 9.0334
4.5167
1.1396
3.3771
2.3771

206

1,15

~~50 | 15~~

210

1 ohm coil
smoking

8° 46'

1,14 Ohms

50 | 210
4.2
4.29 / 1.14 9.9931-10
15.58 Ohms

.6232
.6325
1.1988

2 | 9.1830
4.5975
1.1986
3.3927
2.3927

2° 26. 106 = D

2° 20'

1.1 Ohm

50)104
2.08
4.29

.3181
.6325
comp 1.1 9.9586
0.9092

6.1 Webers 0

.9092

8.5297
1.2948
.9092
3.4056
2.4056
182
2.2874

3262
3.181
182

50)104
2.12

.3263
.6325
9.9588
8

254
264

1.16 Ohms 13° 4'.

50)260
5.28

.7226
.63225
comp 1.16 .9355
19.5 1.2706

19.352
4.3771
1.293.5
2.3825
2.3825

264

1.16 Ohms 13° 4'

1.13

170 = D

5° 49' .164

5D / 170
3.4
4.29

.5315
.6325
comp 1.13 .9469
1.1109

12.9 weber

(9.0058
4.5029
1.1109
3.4920
2.4920

Total 12,175

2° = D

(8.5428
4.2714
3.170
8.6[illegible]
12,175 1.1053
4.9761

7.43 Webers

94 Volts on 12,175 Total

There is a constant of 4° to the left from the current

228 L - 4

1.14 Ohms

10° 36'

50 | 22.4
4.47
4.29

.6474
.6325
current 1.14 | 9.9431
1.2230

16.7 Webers

9.2647
4.6323
1.2230
3.3993
2.3993
126
2.4867

3.577
6.590
6474
126

16.7 Webers

6

85 L

1.10 Ohms

1° 37'

50 | 8.1
1.62

.2095
.6325
1.10 | .9556
.8306 6.32 Webers

1°37

2 | 84504
4.22252
.8306
3.4246
2.4246

164
1.1

6° 54'

8.0 Ohms total

50 / 164
3.28
4.29

.5159
.6325
conj / 1.9547 -10

12.6 ~~[illegible]~~ 1.1631 Webers
x6 .9345
1.0376

9.0796
4.5398
1.1031
3.4367
2.4367

log Volts

		Webers	
	4° 41'	10.5	$\bar{2}.4318$
	19° 40'	21.6	$\bar{2}.4214$
	14° 55	19.2	$\bar{2}.4204$
	19°	23.9	$\bar{2}.3771$
	19° 38	24.0	$\bar{2}.3939$
	10° 17'	15.5	$\bar{2}.4331$
	11° 57'	18	$\bar{2}.4644$
	20 5'	7.5	$\bar{2}.4053$
	5° 20	12.2	$\bar{2}.3999$
	10° 5'	20.	$\bar{2}.3856$
	6° 33'	13.5	$\bar{2}.3933$
	6° 22	14.2	$\bar{2}.3674$
	6° 12	13.7	$\bar{2}.3771$
	8° 46'	15.8	$\bar{2}.3927$
	2° 20.	8.1	$\bar{2}.3974$
	13° 4	19.5	$\bar{2}.3[illegible]$
	5° 49'	12.9	$\bar{2}.4320$
Calculated		7.43	$\bar{2}.3993$
	10° 36'	16.9	$\bar{2}.3[illegible]$
	10 37'	6.3	$\bar{2}.4246$
	6° 54'	12.6	$\bar{2}.4[illegible]$

What is the trouble?

~~Quite strong~~

The wires cannot make so great variations.

The dynamometer seems to be reliable, and I know the principle is correct.

The measurements of the resistances are nearly right as they agree within 1% of each other.

Perhaps I have not taken care enough.

12/96

	Webers	
1° 37'	6.3	$\bar{2}.4246$
2° 51'	7.5	$\bar{2}.4053$
2° 20'	8.1	$\bar{2}.3974$
4° 4'	10.5	$\bar{2}.4318$
5° 20'	12.2	$\bar{2}.3949$
5° 49'	12.9	$\bar{2}.4920$
6° 12'	13.7	$\bar{2}.3771$
6° 22'	14.2	$\bar{2}.3694$
6° 33'	13.5	$\bar{2}.3949$
6° 54	12.6	$\bar{2}.4367$
8° 44'	15.0	$\bar{2}.3627$
10° 57'	15.5	$\bar{2}.4031$
10° 36'	16.7	$\bar{2}.3997$
11° 57	18.7	$\bar{2}.4347$
13° 4	19.5	[illegible]
14° 55	19.2	$\bar{2}.4[illegible]$
19°	23.9	$\bar{2}.8[illegible]$
19° 3[illegible]	24.7	[illegible]
19° 45'	21.6 ~~At~~	[illegible]

May 10

Standard	200 L
No. 1	194 L
No. 2	195 L
No. 3	198 L

No. 2	195 R
No. 3	198 L

Made No 3	100 L
No 2	100 R

Both together 204 to the right

No 2	100 L
2 & 3	200 L
	201

Fixed the galvanometer so that the scale was at right angles to the ray of light. Placed it slightly further away, leveled it carefully

No. 2	100 L
3	100 R
No 2 & 3	201 L
Standard	102
No. 1	100
Standard No. 1	202

Current gave 16 to left when galvanometer

2 | 197 | 3.94 | .5955
| | 1.09 | .0374
| | | .6329
3.94 | 4.29 Volts

4 Daniells

$D = 50$

$D = 2R$ ~~when~~ from current

335 L 50/335
6.7

11" 4'

1.14 Ohms
5

1.09 ~~1.374~~
4.29 — .6329
6.7 — .8261
9.9626 - 10
26.4 1.4216

2 | 9.2831
4.6415
1.4216
3.2199
2.2199

connecting .05 in wire

41

16' 1.08 Ohms

1.08
5
1.03

5.0/41
.82 1.9138
4.29 .6329
9.9666
.5133

3.27 Webers

16'

17.6678
3.8339
.5133
3.3206
2.3206

118 8
2
116

1.15 ohms
5
1.10

1° 37'

50 | 116
2.32
4.29
amp 1.15
8.65

.3655
.6325
9.9393
.9373
2.8454
4.2252
0.9373
3.2879
2.2879

136
2
134

2° 14'

50 | 134
2.68 0.4281
4.29 0.6325
amp 1.03 9.9872
11.1 Volts 1.0478
18.5907
4.2850
1.0478
3.2382
2.2382

1.14 ~~0.0669~~

134

2° 14'

107
7
1.02

10 | 775 | 77..
70
75
70
5

175
170
1

1.08 ohm 1.03
10.6 total

3° 21.

175
775
875
1225
1225
1356 25
76
81375 0
1356 25
217000 0

May 11 P.M.

4 Daniells 50

165 = D − 4 = 161

3° 14′ 3.22

1.07 Ohms

.5

1.02

3.22 .5079

4.29 .6325

amp 1.02 9.9914 −10

1.1318

13.5 Webers

2 | 8.7513

4.3756

1.1318

3.2438

2.2438

222 = D − 4 = 218

221 = D 1.40 Ohms

~~225~~

3° 14′

4.36 .6395

4.29 .6325

amp 1.33 9.8697 −10

1.1417

2 | 8.7513

4.3756

1.1417

3.2339

1/150 1 | 775

155

251 = D

244
4
240

1.57 Ohms
5
1.52

3° 14'

50 | 240
4.8
4.29
amp 1.52

.6812
.6325
9.8182 -10
1.1319

13.5 Webers

260

3° 33'

1.57 Ohms

260
4
50 | 2.56
5.12
4.29
amp 1.57

.7093
.6325
9.8041
1.5459

28.7918
4.3959
1.1459
3 25 00
2.2500

50 for 4 Dynamos

100
96
96
98

1.49 − 4 = 1.45 = 20

1.20 Ohms

30 38'

50 | 1.45
2.9
2.29
amps 1.15
10.8 Webers

0.4624	
0.6325	
9.9393	
1.0342	

18.5058
4.4029
1.0342
3.3787
2.3787

1.18 − .04 = 1.14

1.20 Ohms .05 = 1.15

20 14'

50 | 1.14

2.28	.3579
4.29	.6325
1.15	9.9393
8.5 Webers	.9297

18.5907
4.2953
.9297
7.3656

Constant

158 -4144

1.21 Ohms -5 1.16

3° 31'

50 | 114.4

2.88 .4594

4.29 .6325

comp 1.16 9.9355 -10

1.0274

10.6 Webers

2 | 8.7877

4.3938 very good

1.0274

3.3664

D = 20 -4 194

6° 22'

1.27 Ohms -5 1.25

50 | 194

3.88 .5888

4.29 .6325

comp 1.25 9.9031

13.3 1.1244

| 9.9449

4.5224

1.1244

3.3980

$\bar{2}$.3980

240 = Ω − 4 236

8° 36′

1.28 Ohms ,05 1.23

50/236

	4.72	.6739
	4.29	.6325
Comp	1.23	9.9101 − 10
		1.2165

16.4 Webers

2/9.1747
4.5873
1.2165
3.3708
2.3708

175 = Ω − 4 171

8° 39′

.95 Ohms − 5 90

50 (171

	3.42	.5340
	4.29	.6325
Comp	.90	10.0458 − 10
		1.2123

16.3 Webers

175 27
775
87635
122689
122689
145834
167
1020838
875004
145834
2435278

145834
16.7
1020838
875004
145834
2435427
[illegible]

215 − 41 211

12° 45′

.96 Sun

.91

50/211

.4.22

4.29

Comp .91

.6753

.6325

10.0410 − 10

1.2988

19.9

19.3438

4.6719

13689 4.13621.2988

5.9 0.77083.3831

3.36532.3831

2317

2370

5.0090

1.6435

3.3655

5.9 Total

13° 12′

2(9.3586

4.6793

~~2.3800~~

1.2993

19.9/5.9 .7709

2.0702

117 Volts 2.0702

.0374

107 Dynells 2.0328

117 2.0682

117 2.0682

Comp 5.9 9.2291 − 10

44. 1.6435

102000 ~~5~~.0090

4.5155

3.09 H.P. .4905

10.1 Ohms Total

3° 2.8'

8.7815
4.3907
2.3800
1.0107

10. Weber
1.0107
10.1 1.0043
2.0150

103 Volts

103	2.0128
103	2.0128
comp 10.1	8.9957
44.	1.6435
	4.6648

No 1 Plate

94.925

No. 2 92.155

No. 3 irregular

69.6.47

No. 4.

98.688

May 14 1879 8-45 AM

175

Standard Daniells

$i = 200$ L

No 1 cell	195 L	
No 2 cell	196 L	
No 3 cell	200 R	
No 3 cell	200 L	
No 2 cell	197 R	cell $\frac{95}{100}$ R
No 1. cell	195 L	Standard
Standard	203 R	
Standard	210 L	
	204 R	
4 cells	60 L	

98
4
392
1.09

0.5933
.0374
.6307

4.27 Volts

11th Edison Dynamo machine

The coils connected in series: magnet quantitated

1160 revolutions

D = 146R over .92 Ohm

60 .92 - 5 = .87

Current 4 to D to right

146
4
50 | 142
2.84 .4533
4.27 .6307
comp .87 10.0605 - 10
1.1445

13.95 Webers

2 | 9.0192
4.5096
1.1445
3.3651
2.3651

170 R = D over .95
.95

70 36'

170
4
50 | 164
3.28 .5159
4.27 .6307
comp .90 10.0458 - 10
15.5 Webers 1.1921

| 9.1214
4.5607
1.1921
3.5686
2.3686

183 = D over 1,28 Ohms

4° 53

5
1,23

183
4
50 | 179
3.58
4.27
comp 1.23
12.7 webers

.5539
.6307
9.9201
1.1047

8.9300
4.4650
1.1047
3.3603
$\bar{2}.3603$

144 = D

9° 19'

.75
5
.70

~~2.83 Ohms Total~~

Constant $\bar{2}.3675$

2 | 9.2092 - 10
4.6046 - 5
$\bar{2}.3675$
1.2371

17.2 Webers

144
4
14.0
2.8
4.27
Comp .70
17.08

.4472
.6307
.1549 - 0
1.2328

4.6046
1.2328
3.3718
$\bar{2}.3718$

7° 57'

2.03 Ohms Total

Constant = 2.3617

9.1408
4.5704
2.3675
1.2029
15.9 Webers
2.03
.3075
1.5104 32.4 Volts
1.09
.0374
1.4730 29.7 Daniells

4° 35'

2.38 Ohms Total

8.9041
4.4525 -5
2.3675
1.0850 12.1 Webers
2.38
0.3765
1.4516 28.9 Volts
.0374
1.4242 26.6 Daniells

12° 28'

1.78 Ohms

2) 9.3342
4.6671
2.3675
1.2996 — 19.9 Webers
1.781 — 0.2504
1.5500 — 35.4 Volts
.0374
1.5126 — 32.4 Daniells

May 1880 note Magnets 24 in. by 4 in.
45 coils 3 layers 3 turns No. 18 wire
.056
Armature 6" diameter see plans
6" long
See Book 16
Magnets No. 13 wire .095 in
864 Turns Patch

4° 51'

4° 16' 2.53 Ohms

8.8612
4.4306
2.3675
1.0631 — 11.5 Webers
2.53 — .3979
1.4610 — 28.9 Volts
.0374
1.423 — 36.5

9 wires 15 coils
Magnets quantitated
202) 32.4 (16 Webers
8 Webers each magnet
8 X 864 = 6672 strength
6672

1.2 Ohms

31° 28'

9.7176

4,85.88

2.3675

1.4913 — 31.1 Webers

1.2 — .0792

1.5705 — 37.2 Volts

.0374

1.5331 — 34.1 Daniells

54.0 revolutions

4° 6'

over 1.10

8.8500

[illegible]

[illegible]

1.0[illegible] — 11.4

.690

1.1010 — 12.6 Volts

.0374

1.0736 — 11.8 Daniells

6° .98 . Total

9.0092 - 10
4.5046 - 5
2.3675
1.1371 13.7 Watts
.98 1.9912
1.1283 13.4 Volts

1.1371
1.1283
1.6464
3.9118 8.160 ft lbs
1/4 H.P

1° 22' 1.51 Ohms

8.3775
4.1887
2.3675
.8212 6.62 Watts
1.51 .1790
1.0002 10 Volts

8212
10002
1.8214
1.6402
3.0678 1.160 ft lbs
1/4 H.P

Speed faster 500 revolution

5° 16' 1.54 Ohms

18.9628
4.4814
2.3675
1.1139 13. Webers
1.54 .1875
1.3014 20. Volts
.0374
1.2640 18.3 Daniells

1.1139
1.3014
1.6469
4.0617 11.550

⅓ H.P.

18° 58' 1.01 Ohms

19.5119
4.7559
2.3675
1.3884 24.4 Webers
.1 .0063
1.3[illegible]27 2[illegible]
.1574
1.3553 2[illegible]

1.3884
1.3884
.3[illegible]
1.[illegible]
4.[illegible] 2[illegible]

1° 56'

2.04 Ohms

8.52281
4.2641
$\bar{2}$.3675
.8966 — 7.88
2.04 .3096
1.2062 — 16. volts
.0274
1.1688 — 14.7

.8966
.8922
.3096
44.3 1.6464
− 3.7492 — 5.610 ft lb
+ 4.51185
7693 — $\frac{1}{5.8}$ H.P.

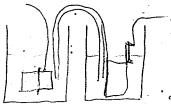
19° 27'

1.02 Ohms

9.5224
4.7612
$\bar{2}$.3675
1.02 1.3937 — 24.7 Webers
.0274
1.3663 — 23.2 volts
.0274
1.3389 — 21.8 volts

1.3937
1.3389
.0548
1.6464
4.4242 — 27.000

Monday June 9 1879



Standard Daniells

Zn well amalgamated
Concentrated solution Zn sulphate
Cons. " $CuSO_4$
Cu Tube containing acid
~~water~~ H_2O before the
water was acidulated
the resistance was so great
as to affect the galvanometer
over ½.

Resistance in line about
55.000 Ohms

D = 230 Standard

NoD4 = 215 No. 1
227 No. 2
200 No. 3 cement just
200 finished.

D = 237 R Standard
235 R
233 R

Standard 40
No 1 70

4 cells . 200

	215
	227
	200
	235
	877

877	2.9430
235	.13711
3.73 Daniells	.5717
109	.0376
4.07 Volts	.6093

Fiducial. 5° 31' R

5° 2 8'

Gramme 265°

over .96 Ohm

1° 38' R

2.65 .4232

Volt. 4.07 .6096

comp. .96 19.0177 -10

1.0505

11.2 Webers

5° 30'

1° 38'

3° 52'

~~8.8288~~

2 | 8.8288

4.4144

1.0505

3.3639

5

2.3639 Constant.

D = 335°

over 1 Ohm

1° 20 R

Total cold

5.4 Ohm

---

335 .5250

407 .6097

1.1347 13.6 Webers

5° 30

1° 20'

6° 50

2 | 9.0754

4.5377

1.1347

3.4030

2.4030 = Constant

13.6 1.1347

5.4 .7324

73.6 Volts 1.8671

1.1347

3.0018

44.5 1.6484

44,600. 3.6502

Just 2h

June 9. P. M.

No. 1 200

No 2 200

No 3 200

Standard 205

Made the force = 50

$C_1 = \sqrt{\sin^2 D_1}$ $\qquad C_1^2 =$

$C_2 = \sqrt{\sin^2 D_2}$

$\frac{C_2}{C_1} = \frac{\sqrt{\sin^2 D_2}}{\sqrt{\sin^2 D_1}}$ $\qquad \sin D_1 = C_1^2$

$\sin D_2 = C_2^2$

$\frac{C_2}{C_1} = \frac{\sqrt{\sin D_2}}{\sqrt{\sin^2 D_1}}$ $\qquad \frac{C_2}{C_1} = \frac{\sqrt{\sin D_2}}{\sqrt{\sin D_1}}$

$C_1 = \frac{\sqrt{\sin D_1}}{\sqrt{\sin D_2}} C_2$)

$C_1 = \sqrt{\sin D_1}$ / Weber

$C_1 = \frac{\sqrt{\sin D_2}}{C_2}$

~~$\sin C_1 =$~~

$\frac{C_1}{C_2} = \frac{\sqrt{\sin D_1}}{\sqrt{\sin D_2}}$

$\frac{C_1}{\sqrt{\sin D_1}} = \frac{C_2}{\sqrt{\sin D_2}}$

$\frac{C_3}{\sqrt{\sin D_3}} = \frac{C_1}{\sqrt{\sin D_1}}$

$C_3 = \frac{C_1}{\sqrt{\sin D_1}} \sqrt{\sin D_3} = \frac{\sqrt{\sin D_3}}{\sqrt{\sin D_1}}$

$\sqrt{\sin D_1} = \frac{\sqrt{\sin D_3}}{C_3}$

205) 805 (
4

805
205

3.92 Dam

4.28

.9058
.3198
.5946
.0374
.6314

805
20 #

Fiducial 5° 23'

D = .150
= .145 12' R

over .96 Ohm

50/148
2.96 .4713
4.28 .6314
comp .96 .0177
1.1204 13.2 Webers

5° 23'
12
5011

2/8.9558
4.4779 - 5
1.1204
2/3.3575 Constant

Euphase 4.4779.5
3.3373
1.1406
1.29 webers

.4713
.6314
91. .0410
1.1437 12.9 Webers

4.4779
1.1437
5.3342 Constant

D = 55 over .95
4° 43'

50/55
1.1 .0414
4.28 .6318
.95 .0223
.6955 4.96 Webers

5° = 23
4° 43'
40'

2/8.0657
4.3328
.6955
2/3.3373 Constant

comp .90 .0414
.6318
.0458
.7190 5.24 Webers

4.0328
.7190
2.3138 Constant

D ÷ 208 over 1.32 ohms

5' R

50 | 208
4.16
4.28
1.32

.6191
.6314
9.8794 -10
1.1299

Comp

13.5 Webers

5°23
5.1
5°18'

2 | 8.9655
4.4827
1.1299
2.3528 Constant

.6191
.6314
1.27 9.8962 -10
1.1477

14.05

4.4827
1.1477
2.3350 Constant

D = 240 over 1 ohm

7° L Total 4.1

50 | 240
4.8
4.28

.6812
.6314
1.3126
.6128
1.9254

4.1

21.2 Webers
84.2 Volts

7°
5°23'
12°23'

2 | 1.3813
4.6656
1.3126
2.3530

Instead .05 for resistance leading wires

.6812
.6314
.0223
1.3349
.5977
1.9326

.95

Total 3.95

21.6 Webers
85.6 Volts

4.6656
1.3349
2.3307 Constant

5° 28' Fiducial

.56 Ohm in lamps

2°. 58'

5° 38' Fiducial

Wires .047 Ohm to be taken from all measurements

Connecting wire in lamp .025 Ohm

.01

.035 to be taken from lamp

.035
.047
.082

.56
.082
.478 in lamp

5'38
2 58
2° 40

10 Webers

	8.6876
	4.3338 - 5
	2.3300
	1.0034

100	2.
.478	$\bar{1}$.5009
	1.6609
44.5	1.6484
2040	3.3093

3/5000	4.5185
	3.3003
	1.2092

16.1 per H.P.

204 Page 137

suppose 10 Weber
and .7 Ohm in lamp

	2	
	7.8451	
44.5	1.6484	45.185
3770	3.4935	3.4935
		1.0250
	~~[illegible]~~	10.5 H.P.

Instead of 8.7 per H.P. which shows the need of economy

Economy 1040 watts with lamps
70 to 1 on current

4 Daniell = 5

120 to 1 ~~[illegible]~~ .65 − .05 = .60
115

50 2'

115 L

110 L .64 - 5 = .5 - 4 Ohm

4° 30

4° 23'

6.3 Ohm Total

1110

June 10

Standard 200

200

No. 3 195

No. 2 205 205

No. 1 200. Total

208

June 10 P.M.

~~105~~ 4 Daniells 50

New machine slowest 268 revs.

Speed driven by Gramme

3° 22′ Current on dynamo

105 Δ on Galvanometer

95 over 1.65 Ohms

Total 9.1 Ohms

New Machine Gramme on magnets 209 2.4

50/105. June 10 268 revs 4/4

436

2.1 .3222

4.36 .6395

Coef 1.65 9.7825 ~10

.7442 5.55 Weber

9.1 .7442

5.55 .9583

.7132 50.5 Volts

3° 22′ 2/8.7688

4.2844

3.3300

1.0544 11.2 Webers

on magnet

Deflection constant 2.3500

1.0344 10.8 Webers

2.10

June 10

Same 11.2 Webers from Gramme Magnets

100 R on new machine over 1.34 Ohms

Total resistance = 7.7

4.36
2.
8.72 .9405
Comp. 1.34 .8965 10
.8166 6.55
7.7 .8865
1.7131 50.4 Volts

.8166
.8166
.8865
44.5 1.6484
41681 14.700 foot lbs

Work from New machine

Current on magnet 10 5 6' June 10

New Machine

95 R
1.32

Total 7.3 Ohms

8.5241
4.2620
2.3300
.9320 8.55 Webers

95
1.9 .2788
4.36 .5215
Comp. 1.32 0.8004
.7947 6.26 Webers
7.3 .6288
7.6610 45.7 Volts

.9320
.9320
1.3484
2.5124

3255 foot lbs on magnet

June 10

11.2 : 8.555 :: 50.4 : 38.5

50.4	1.7031
8.55	.9320
amp. 11.2	8.9508
	1.5859

If the E.M.F. falls proportionally to the current of the magnet it should have been 38.5 instead of 45.7 Volts.

~~If it fell as the squares~~

If the square of the E.M.F. fell

$11.2 : 8.55 :: 50.4^2 : x^2$

This is quite near see Pb. 229-330

1.7031
1.7031
.9320
8.9508
2 | 3.2890
1.6445

June 10

instead of
45.7
44.5 E.M.F.

11.2
11.2
44.5
5450
2.73.68

Magnet
New machine
Armature

Wednesday June 11. 1879.

No. 1 Daniell 220
No. 2 220
210 L
220 L

No 1 Standard 215 L
215 L
225 R

4 cells 50 100 / 428

shall take Daniells as 1:07 Volts as the Standard was the same as the other cells

June 11

New machine speed 268 revs on its own field

Very slow in coming up

190 L over 1.67

2° 47 I consider the leading wires as about equalling the loss by delay in measuring

50 / 190
8.8
4.28
Imp 1.67

.5798
.6314
.7773
.7885

9.74 Webers

2° 47

=) 8.6862
5371
9725
3.3546

185 1.68

2° 26'

6.20 after 2 minutes
6.25 on account of discharge of magnet

probably 6.3

50 | 1.85
3.7 .5682
4.28 .6314
comp 1.68 9.7747 -10
.9743

9.42 Webers

2° 26' | 8.6279
4.3139
.9743
2.3396

9.42 .9743
6.3 .7993
1.7736 59.3 Volts

I do not understand how this is! for yesterday having the Gramme machine on the field giving a current of 11.2 Webers the Edison only gave an E.M.F of 50.4 Volts!

See page 223 where reading today shows an E.M.F of 60.5 there being 8.26 Webers on field.

Yesterday's reading perhaps wrong. The speeds were the same by revolution meter

.155 R. over 136 - .045 = 1.315

1.32

2° 55'

After one minute 1.34

Two 1.33

6.35 Ohm. One minute after kilf

50/155

3.1

4.28

.4914

.6314

Comp 1.32 9.8794 - 10

1.5626

10.0 [illegible]

2° 5' 5

8.7065

4.3532

1.0028

3.3506

63.5 Volts

Perhaps having the ~~magnet~~ in circuit really increases this E.M.F. acting as a reservoir to bridge over small variations. Not as.

Ex. Put the dynamo through the magnet and test its E.M.F. also without magnet in circuit. No dif.

Found that the dynamometer [illegible] a [illegible] when [illegible] magnet [illegible] movement. Don't the reason for this is the surface of the Hg.

150 R over 1.33 - 4.15
1.29

2° 53'.

6:3 about seven minutes after stopping machine

.50/150
3.5

4.28
3
12.84
Comp 1.3

1.1072
9.8861
.9938 9.1

9.95 Watts

2° 53
8.7015
4.3507
.7933
2.3574

9.55
6.3
.9933
.7973
1.7926 62 Volts

Gramme machine
1.040 revs, large magnet in circuit

FOR

The dust on the Hg. on the Dynamometer seemed to cling to the points and damper very strongly. The vibration the ~~[illegible]~~ points were removed freeing them from dust

June 11

782 R over 1.35 —

3° 48 Total 6.45 —

50/182

	3.64	.5611
	4.28	.6314
Amp	1.35	7.8697
		1.0622

11.5

6.45	.8096
11.5	1.0622
	1.8718

74.4 Volts

3° 48

8.8213
4.4106
1.0622
2.3474

Constant

June 11 P.M.

Gramme on field 7° 56'

Total 5.32

50/170 R over 1.32 - vs .1.28

	3.4	.5315
	4.28	.6314
Amp	1.28	9.8928 -10
		1.0557
	5.32	.7259
		1.7816

11.3 Webers

53.5 Volts

On field

1° 56'

8.5243
4.2621
3.3450
.9171

8.26 Webers

Revolutions 268 per minute

None lost by belt slipping

June 11 P. M.

Gramme 8'

Total 5.4 Ohms

150 R over 1.34 Ohm
-5
1.29

8.7188
4.3594
3.3594
1.0144 10.3 Webers

180 2.2553 New Machine
52 1.7160
.5393
3.46 .6314
4.28 9.8729
Sample 1.34
5.4 1.0436 11.0 Webers
.7324
1.7760 59.7 Volts

June 11 P. M.

Short circuiting brought up the field on from 135 R ~~140 R~~ to 140 R

When Gramme taken off 15 R over 1.29 Ohm

First 20 ohm in about a minute 15 and two minutes 10 to

Opened the circuit so that the galvanometer formed part of the circuit 5 1/2 the right from the permanent magnetism

42 Volts

A sounder placed in the circuit gave break. Mr. E. found that it was due to lack of pressure on the commutators.

P

June 11 P.M.

~~Gramme field~~

New Machine 5.71 50' 5.35 Ohms Total

Gramme on field

160 on 1.32

~~5.64~~

50 2 | 8.1626
4.0813
2.3456
.7263
.7284
.535 1.4647

5.45 Webers

29.1 Volts.

Gramme 160 2.2071
.52 1.7160
.4881

4.28

Comp 1 3

June 11 P.M.

Gramme on Galvo

186 to left

New on Dynamometer

Gramme on Dynamometer

7561
2 268427
2,275988
154700
2,460688
2.457162
9.526
2268427
2259900
8527

175.27
775
87635
122689
122689
135834 ~~2.5~~
16.7
950838
~~5504~~
815004
135834
226,8427.8

3 ~~00~~ | 2,268,427.
7561

June 11 P.M. — Gramme — New Machine — Dynamometer

175 L	2° 14'
130 L	1° 49'
35 L	23'
280 L	2° 46'

Total 6° 12' Turns

4 Daniells 52 G R
52 L

Perhaps the constant of Dynamometer has changed as I changed the Hg.

June 11 P.M. — Gramme

52) 175 (3.36
156
190
156
340
Ondi.

3.36
4.28
1.27

.5263
.6314
.3894
1.0471

.5206

11.1 Webs

2° 14'

8.5499
4.2749
3.3450
.9299
.7993
1.7292

6.3 V

8.51 Webs

~~54~~ Volts

53.6

3) 130 (2.46
126
40
28
120

2.46

.3909
.5204
.9113

Gramme

8.15 Webs

1° 49'

8.5010
4.2505
3.3450
.9055
.7892
1.6327

6.3 V

8.04

42 Volts

June 11 P.M.

23'

7.8254

8.9127
3.3450
.2577

1.82 Watts

52) 350 (.67
312
380
364
160

7.8261
.5208
.3469
.7000
1.0469

2.22 Watts

11.2 Volts

52) 280 (5.57
260
200
260
400

.7459
.5208
1.2667

15.4 Watts

20 46'

1.6836
4.3418
3.3450
.9968
.2292
1.7260

9.9 Watts

53.2 Volts

4.3418
3.3200
1.0118
.7292
1.7410

10.2

55.1 Volts

June 11 A.M.

141 ; 8.85 :: 8.51 ; 24X

62.7

.9117
.9299
8.9529 -10
8.7945

x^2

.9117
.9299
.9299
8.9529
1.7444
.8722

55.5

7.45 - x^2

8-15 ; 1.82 :: 8.69 ; 2

9.0883-10
.2577
.9055
1.78 .2515

9.0883-10
.2577
.9055
.9055
2 11.2570
.6285

425

June 11. 1899 P.M.

As the magnet is nearly saturated the ~~E.M.F. of the~~ increase of the E.M.F are proportional to the strength of the current around the nicagnet. see p.212

The law for this to be thoroughly tested

June 11 8 P.M.

New standard cell

Thoroughly amalgamated Zn in solution of $ZnSO_4$, a siphon used to connect this with a saturated solution of $CuSO_4$ having a Cu. plate in it.

$E_1 = 200$ L $D = 20$ R

Another cell the same only having an porous cup in place of siphon to separate the fluids

$D = 206$ ~

The resistance of the first must be very great as there are about 60 ohms in the circuit and its E.M.F is 900 volts in same, for when the two are connected upon a deflection of 5 to left is obtained

Dupre 11

showing that the cell with porous cup has the greater E. M. F. to 5

25% greater Zn in porous Mod
∴ Siphon 202

Now why?

Look the solutions and Zn. from the cell with siphon and put in porous cell 200 L. 205 R.

Changed Zn.

205 L 206 R
205 L
0
0 205 L
206 R

Changed to Zn from Siphon

205 L
206 R

Dupre 11

In the siphon cell No. 1 Zn.

203 R
200 L

allowed a little air to bubble over into the Zn cell no change

against each other 2 L
1 R

~~Constant deflection~~ made 0

0
against each other 1 R
2 L

Siphon 200 R
Porous 205 R
Siphon 202 L
Porous 205 L

June 11

No. 3 185 L
No. 2 202 L

No. 2 and Siphon
6 L

Siphon 200 L
No 3 200 L

Side by side 200

Siphon 202 R
No. 2 202 R

Siphon about 4 R stronger

0

June 11

Siphon 201 R
Porous 205 R

against each other 0 "exact"

~~Siphon 200 L~~

Porous 205 L
Siphon 200 L

against each other 0 "exact"

The siphon has a very large ~~[illegible]~~ allowance and at first ~~[illegible]~~ had an fluids of different density [illegible]. Also some unknown disturbance perhaps movements or wind [illegible]. Better use the porous cups as being more exact

porous and No. 3 20 R
23 L

Porous 20 stronger

porous 205 R 205 L
No. 3 180 R

June 11 single

The difference of E. M. F. is greater than the difference. Coils placed against each other

Internal resistance of Siphon battery 1200 ohms

Standard 200 R & L forces
No. 3 185 ~~R~~
No. 2 197
No. 1 190 L 192 R
Standard 200 L
No 1 192 R
No. 4 or new cell flinds battery
mixed 170 right
No. 2 193 L
190 L
No. 1 190 L
No 3 new 192 L
Standard 200

June 12 a.m.

Newly arm

No. 1	192 L	192 R
No. 2	190 L	192 R
No 3	193 L	192 R
Stand	200 L	200 R

New machine

D = 210 on 1.62 Ohm

4° 26' 5.7 Volts Global

$\sqrt{210}$

4.2	.6232
4.23	.6263
Comp 1.62	9.7905
11.0 Volts	1.0400

June 12 a.m.

192
192
192
200
200 / 776
3.88

388
109
3492
3 88
4 2.2 9 2

268 revs

4° 26'

8.8881
4.5443
1.0400
3.9040 Constant

5.7
57
57
62.7 Volts

June 12 a.m.

D = 214

268 mod

70° 25'

50 | 214

4.28

4.23

avrg 1.3

1.33 Ohms

·4 = 1.29

4.7 total?

·6314

·6263

9.8851 · 10

1.1438

13.9 Watts

7° 25

9.1108

4.5554

1.1438

5.4116 Constant

4.7?

13.9

·6721

1.1438

1.8159

65.4 Volts?

June 12 a.m.

Took the resistance coils to see how long ~~it took~~ they required in cooling

~~5.05 Ohms~~

15 sec · 136

20 " 135

20 " 134

25 " 137

20 sec 132

1 min 131

June 12 a.m.

First time required in cooling

268 mm

30	13.4
25	13.3
25	13.2

about every 20 sec. .01 ohm to be added to the resistance of the

140		
139		
138		
137	30	
136	15	
135	20	
134	20	
133	25	
132	45	
131		

June 12 a.m.

268 mm

195 L

after 50 sec 135 + 3-5

Total 5.05

6°

50 195

5.9	.5911	
4.23	.6232	
1.32	2.8861 - 10	
5.05	1.0914	12.3 Watts
	.7232	
6°	1.7137	62.1 Volts
19.0192	probably	64 Volts
4.5096	[illegible]	
1.0904	[illegible]	
2.4192	Constant	

June 17 ~~[illegible]~~ 1.25 P.M.

268 rev ~~[illegible]~~ 4 Daniells gave 46 L
45 R

Perhaps this was as this morning and altered all my results and made the Constant of the Dynamometer higher than before.

~~4 Daniells~~ Standard 200 L
195 R

No 3 190 R

Federal Chemical 5 L

Again

Standard	195 L	
	198 R	196
No. 3	194 L	192
No. 2	191 R	189 L
No. 1	191 L	189 L
		766

.8642
.2923
.5919 3.91 Daniells
1.89 .0374
.6293 4.26

4 Daniells June 17 50 L —
268 rev 50 R +

New machine on its own field

200 over 1.34 ohm
340 res.
50 49' 1.33
5° 45'

4	.6021	
426	.6293	
amps 1.33	9.8761	
	1.1075	12.8

5° 49'

90058
1.1075
3.4954 Instant

248 mo 182 L over 1.34 Ohms

4° 44'

50 | 182

	3.64	.5611	
	4.26	.6294	
comp	1.38	9.8761	
		1.0666	11.5

4° 44 | 8.9165

4.4582

1.0664

2.3916

Tube brought up

245 mo 145 L 1.32

3° 4'

145 | 2.9

Not brought up 143

2° 59'

	2.9	.4624	
	4.26	.6294	
comp	1.32	9.8794	
		.9716	9.07

2° 59 | 8.7163

4.3581

.9716

.3865

268 read

117 over 1.22

2°

(117

2.34	.3692	
4.26	.6294	
1.3	9.8861	
	.4849	7.67
	5	

(8.5424

4.2714

8547

2.3867

268 read

103 Ω

8.5 Ohms

1° 37'

Took out five Ohms and put back

93 Ω

1° 19'

(103

2.06	.3139	
4.26	.6294	
1.3	9.5561	
	.8294	6.75 Volts

(8.6504

4.2252

.8294 83

.3958

.8294

.9191

1.7485

56 Volts

14. L

.121

50 (14

.28 $\bar{1}.4472$

4.26 1.6294

1.3 9.8861

$\bar{1}.9627$

.91 Water

(7.5429

3.7714

$\bar{1}.9627$

$\bar{1}.8087$

DG

250 L 1.37

2.48 Wind 90 141

Total 3.95 Mins.

5 .6990

4.26 .6294

1.37 9.8633

.1917 15.5

3.95 .5966

(9.2053 1.7883 61.4

4.6026

1.1917

2.4109

198 268 ohms

5.1 Total

5° 38'

5 | 198
3.96
4.26
amp. 1.35

.5977
.6294
9.8677
1.6968

12.5 Watts

5° 38

E.9919
4.4959
1.0968
2.3991

5.1 1.0968
.7076
1.8044

63.7 Volts

268 ohms 150

6.14 Total

3° 30'

3
4.26
amp 1.33

.4771
.6294
.8761
.9826
.7885
1.7709

6.14

9.61
59 Volts

3° 30

2 | 8.7656
4.3828
.9826
2.4102

254 4 Dwellings 50 L
51 R

268 mm

153

6.1 Total

3° 22'

153°

3.06 .4857

4.26 .6294

1.33 9.8761

Comp. .9912 .98 Watts

.055

3° 22 8.7688

4.3844

.9912

2.3732

.9912

.7853

2.1 1.7765 59.7 Volts

268 mm

124

2° 3' 7.1

50 / 124

2.48

.3945

.5055

.9000 7.94

2° 3

.85535

1.7767

.7553

2.3707

7.1 .9000

.8513

1.7513

56.4 Volts

4.2767 Surface

2.4000

.7553 7.53

Gramme on field

2° 30' on 3.32 Ohms

Total 24.6 Ohms

98 L

8.6396
4.3198
2.4000
.9199 8.3 Webers

.198
1.96
4.26
comp 3.32

.2923
.6294
9.4989 = 6
.1283
.4106 2.57 Webers
24.6 .3909
.8015 63.3 Volts

2° 14' No change in Gramme except from heating

50 L 3.32

Total 45.3 Ohm

.1283 . 1.28 Webers
.5561
45.3 .7844 63.9

2° 14'

2 18.5907
4.2953
2.4000
.8953 7.86 Webers

261 6° 30' Grammes

269 mm

55 L on New Machine

9.0538
4.5269
2.4 ohms
1.1269 13.3

268 mm 9° 7'

261

58

9.1998
4.5999
2.4 ohms
1.1999 15.8 kilo

262 June 12 150 Gram

268 rev

60 New machine

150

(9.4130

4.7065

2 4000

4.3065 20.2

June 12 48 = 4 Dynamos 263

52 first speed 268 rev

70 400

100 500

137 731 RC

169 1010

210 1380

on 3.3

Gramme 30,1

Total 46.3

(8.7212

4.3606

2.4000

.9606 9.26 Watts on field

264 June 12

Comp 48 — 8.3198 −10
4.23 — .6263
Comp 3.3 — 9.4815 −10
2.4276
268 revs. 5.2 — 1.7160
1.26 volts — .1336
46.3 — 1.6646
64.1 Volts — 1.8072

~~Comp 340~~ 340
2.4276
1.6646
0.0922
70 — .8451
86.6 Volts — .9373

520 revs. 123. Volts — 2.0922

731 revs. 137 — .0922
2.1367
169 Volts — 2.2289

1010 revolutions June 12 — 26

.0922
169 — 2.2279
21.0 Volts — 2.3281
192 Daniells — .0374
2.2837

1380 revs. 210 — .0922
2.3222
260 Volts — 2.4144

I take for granted that the resistance of the whole circuit increases proportionally to the resistance around the galvanometer which must be nearly the same

June 13

4 Daniells 50

The machine on the pulley marked 500 only ran 320 5 Ohms Total
belt slipped so low measurement

50 | 16.5 over 1.29

	3.3	.5185
	4.23	.6332
Comp	1.29	9.8894
		1.0411
	6.2	.7924
		1.8335
		1.0411
	44.5	1.6484
		4.5230

Total 6.2

11 Webers

68.1 Volts

33,300 ft. lbs.

~~1.75 HP~~

Belt probably slipped

220
215 423 rev
over 1.3

6.3 Ohms Total

50 | 215

	4.3	.6335
	4.23	.6[illegible]
Comp	1.27	.8962
		1.5560
	6.3	.7[illegible]
		1.4[illegible]
		1.[illegible]
	44.5	1.6484
		4.75[illegible]

93.2 Volts

57,500 ft. lbs.

at June 12

255 on 1.32

6.35 Total

5 | 255
5.1

4.23 .7076
Comp 1.29 .6263
9.8894
1.2233 16.7 Webers
6.35 .8028
2.0261 106. Volts
1.2232
44.5 1.6484 → 5
4.8978

33.000 | 179.000 At. lbs.

4.8978
21 5185
0.3793

2.4 H.P.

Jumps the three breaks in the circuit

600 revolutions June 12

240 1.33

270 June 12

Page 137 Lamp .77 on Gram

.75	1.8751
105	1.0212
	.8539
7.14	7.8865
.77	.9674
9.28 8 lamps	.9674
	1.9348

E.M.F. for 100 Ohm lamps.

$E_1^2 : E_2^2 :: R_1^2 : R_2^2$

$E_1^2 : E_2^2 :: a_1^2 : a_2^2$

$E_1 = 75$

$E_2 = x$

$R_1 = .77$

$R_2 = 100$

75

1.8751
1.0251
.1135
5.8537
2.

June 12 ~~8 lamps~~ Resistance of machine = 9.2 ~~7~~ or lamps, each .77

having a Ohms resistance requires an E.M.F of E

Now large an ~~resistance~~ E.M.F. will ~~8~~ lamps of 1 Ohms require in circuit

$\frac{E}{n}$ = E.M.F on one lamps of a resistance

It will require

75
9.28

$\sqrt{a} : \sqrt{b} :: E : x$

$a : b :: E^2 : x^2$

a = .77

3.9289

~~1.8544~~ 75.2

1.9644

1.8751
1.8751
2.
.1135
5.8537
~~2~~
.9674
4.8863
.9674
3.9289

June 12

$a \mid b :: \varepsilon^2 : x^2$

$a = .77$

$b = 100$

$\varepsilon = \frac{75}{9.28}$

10.1135 -10

2.

1.8751

1.8751

9.8325 -10

9.0325 -10

.2 | 3.9287

1.9643

~~#~~ Volts

92.1 Volts

June 13

Standard 213 L 210 L 212 R

Zn. and Cu. solutions with strontia

No. 3 199 L 203 R

No. 2 193 L 195

193 L 194 L

195 R

No. 7 207 L

210 R

Test of Zn regulation

having 20 cm strontia.

1 cell Daniells 103 R

$\frac{13}{100}$ or .33 Ohm

on magnetation

135

297 1 cell Fullerm June 13

22/100 on .66

125 on regulator

2 cells

250 255 on regulator

35

30 on .66 Ohms

19 on .33 Ohms

11 L .66

25 L

Fiducial 4 R

June 13 Standard 99 L 295

99 R

2 cells

on .33 Ohms

15 R

very fast

on Regulator 270

on .66 Ohm 29 & 30

on Regulator 255

1 cell

.33 19 R

135 L

2

June 13

.66

U = 20

Regulator 12.5

$\frac{15}{99} \times 1.09 \times 44.5 \times 3$

3	
133.5	2.1253
1.09	.0374
15	1.1761
Comp	8.0044
	1.3432
220 ft lbs	270 2.4314
	15 8.8229
	2.6085
408 ft. lbs	
	4.5185
	2.6085
8V for H.P.	1.9100

June 13

255

1.09

Comp 99

44.5

Comp .66

.4065

Ou .33 Ohms S. M. 7

$\frac{15}{99} \times \frac{1}{.33} \times 1.09$

15	1.1761
1.09	0.0374
Comp 99	8.0044
Comp .33	10.4815
.5 Webers	7.6994
	7.6994
	7.5185
1.1761	7.9973
8.0044	44.5
7.1805	7.5185
.15 Volt	0.1558

3.59 ft lbs

on .33

0.5555.8 June 13

270 2.4314
comp 15 8.8239
1.8111

64.7 ft. lbs.

45185 3300
1.8111
2.7074 3300

510 per H.P.

.66
Regulator stopped
51

Regulator running 30

Regulator running 255

Regulator stopped ~~30~~ ~~255~~
190

June 13.

190/51 X .66

2.2788
1.8195 -
8.2924
.3867

2.46 Ohms

Wheatstone 3.2 Ohms

Varies a good deal

Say 3 Ohms

7.6994
7.6994
3 .4771
44.5 1.6435
1.5294

33.8 ft lbs in the turbine

64.7
33.8
30.9 ft lbs in motion

280

June 13

33,000 4.51855

~~324~~ 30.9 1.4900

3,0285

1067 per H.P.

$\frac{201}{99} \times 1.07 \times \frac{1}{.36}$ = Webers

1.4624

8.8044 − 10

.0374

10.1805 − 10

9.6851 4.84 Webers

7.6851

1.86 1.8995

44.5 1.6484

.8381 6.89 ft lbs

255 .8381

cos 29 2.4065

8.5376 − 10

1.7822

60.5 foot lbs used

June 13 281

1 weber current [illegible]

a 100 ohm [illegible]

say 30 ft lbs [illegible]

[illegible] $\times$ [illegible] = 30 ft. lbs.

$x = \frac{30}{44.5}$ = about [illegible]

per a 3/4 of an ohm [illegible]

~~ought to be~~ the [illegible]

since 30 ohm [illegible]

1/2 Weber current

Hand lumber a 14 Medium large fly wheel, wood pulley –

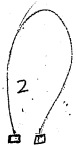
6660 ft lbs outside,

4

33.

22
13
66
22
5000.
1000

9000



13.
6
19.

25
13
75
25
325

18,

9

43
43
129
172
1849
1844
7396
7396
81,356

12/81,356

15/81356 (5423
75
63
60
35
30
56
45
11

10.
25
100.
60.

10
30
50

1234567890
1938247 5

10

$\frac{1}{4}$
$\frac{1}{4}$

1
2
3
4
5
6
7
8
9

4

37

17

20

17

3
2 1/4
2